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INTRODUCTION

Structures throughout the Naval Shore Establishment are subject to corrosion and deterioration from the natural environment and must receive protection to minimize this effect and the resulting costly repairs. Painting is the most widely used method for minimizing corrosion of large surface areas because of the simplicity of application and the relatively low cost.

To provide satisfactory, long-lasting protection, however, the coating must be able to resist chemical and physical attacks from the environment in which it is exposed; must be able to maintain good adhesion with the substrate while it is in service; and must be able to form a hard, impervious film with minimum mechanical defects. Any factors which reduce any of the above properties will initiate early failure of the coating and lead to deterioration of the structure which the coating was intended to protect.

Oleoresinous and modified oleoresinous (e.g., alkyd) paints are, by far, the most widely used coatings in the Naval Shore Establishment. An important factor which affects overall protective properties of such coatings is their loss of drying power during storage. Slow-drying films are vulnerable to chemical and physical attack from the environment during the prolonged drying process. This loss of paint drying power during storage is believed caused by adsorption of driers by the pigments. With this condition, the drier will not be available to the paint resin to accelerate the oxidation process necessary for curing.

Uncured films (i.e., soft) are not only easily damaged by external forces but are also more permeable to moisture or corrosive elements than cured films are. Impregnated impure or corrosive elements during the prolonged curing process will ultimately affect the overall protective properties of the films.

The purpose of this work unit is to conduct a detailed study of the mechanism of drier adsorption and provide valuable information, leading to coatings which retain good curing properties during prolonged storage and thus provide better deterioration control for structures at Naval activities.

BACKGROUND

Although adsorption of paint driers by pigments during storage has been long suspected (Ref 1 to 4), experimental data to verify this hypothesis are lacking. This lack of data is related to the absence of an accurate and reproducible procedure for measuring small quantities of driers adsorbed by paint pigments. These amounts are usually too minute for accurate measurement by the usual analytical methods.

Unmodified oil or alkyd paints normally contain a combination of 0.01% to 0.08% by weight* of cobalt or manganese drier (e.g., cobalt or manganese naphthenate), or both, and 0.2% to 0.8% by weight of lead drier (e.g., lead naphthenate). Only fractions of these small amounts were suspected of adsorption on pigment surfaces during storage. Thus, accurate measurement of the minute amount of adsorbed paint drier is extremely difficult when conventional analytical methods are used.

The Civil Engineering Laboratory (CEL) sought to develop a new technique for measuring adsorbed paint driers on the pigment surfaces by using radioactively tagged paint driers (i.e., cobalt-60, lead-210, and manganese-54 naphthenates) as tracers. This report describes the development of the radioisotope tracer technique and its application to the investigation of factors that play an important role in drier adsorption on pigment surfaces.

PREPARATION OF EXPERIMENTAL PAINTS

Synthesis of Paint Driers

Three soluble metal driers, (cobalt, lead, and manganese naphthenates) were synthesized by reacting metallic salts (acetates) with a long-chain organic acid (naphthenic acid), as described in Reference 5. This reaction is illustrated with cobalt naphthenate in the following equation:

$$Co(C_2H_3O_2)_2 \cdot 4H_2O + 2(R - COOH) \rightarrow Co(R - COO)_2 + 2H(C_2H_3O_2) + 4H_2O$$

where R = naphthenic acid radical

Radioisotopically tagged driers were synthesized in exactly the same manner except that radioactive metallic salts (cobalt-60, lead-210, or manganese-56 acetates) were used in place of the nonradioactive salts as in the following equation:

$$Co^{60}(C_2H_3O_2)_2 \cdot 4H_2O + 2(R - COOH) \rightarrow Co^{60}(R - COO)_2 + 2H(C_2H_3O_2) + 4H_2O$$

<u>Cobalt Naphthenate</u>. The radioactive and nonradioactive cobalt naphthenate were prepared in the same manner. Thirty grams of naphthenic acid were weighed in a 500-cc beaker and heated to 200°C. Twelve and one-half grams of cobalt acetate were slowly added, allowing the reaction to subside between the addition and agitation. After all the cobalt acetate was added, the temperature of the solution was kept at 200°C until the evolution of acetic acid and water was completed. The final

*Based on the total vehicle solids.

product was diluted with 33 grams of mineral spirits while stirring. The resulting cobalt metal concentration in the drier was 5.68% by weight.

Lead Naphthenate. Each was prepared in the same manner. Thirty grams of naphthenic acid were weighed into a 500-cc beaker and heated to 200°C. Nineteen grams of lead acetate were slowly added, allowing the reaction to subside between the addition and agitation. After all the lead acetate was added, temperature of the solution was kept at 200°C until the evolution of acetic acid and water was completed. The product was diluted with 22.0 grams of mineral spirits while stirring. The lead metal concentration in the drier was 17.71%.

Manganese Naphthenate. Each was prepared in the same manner. Thirty grams of naphthenic acid were weighed into a 500-cc beaker and heated to 200°C. Nineteen grams of manganese acetate were slowly added, allowing the reaction to subside between the addition and agitation. After all the manganese acetate was added, temperature of the solution was kept at 200°C until the evolution of acetic acids and water was completed. The product was diluted with 22.0 grams of mineral spirits while stirring. The manganese metal concentration in this product was 7.09%.

Basic Paint Materials

Nine different generic, government specification coatings were specially prepared by the paint manufacturers by eliminating paint driers in the coating formulations. Three of the nine experimental paints were excluded from the experiment because they did not conform to the specification, making their use without meaning. Details of the remaining six paint formulations are given in Appendix A. All were analyzed by methods specified in References 6 through 8 to determine physical properties and chemical composition. The physical properties (weight per gallon, drying time, specific gravity, and consistency) and chemical properties (nonvolatile solids, total pigment, and nonvolatile vehicle) are listed in Table 1.

PAINT STORAGE

Each of the paint driers was synthesized as described in the preceding sections and was carefully added to each of the six paints and thoroughly mixed for storage and subsequent experimentation. The amounts of driers, both radioactive and nonradioactive, added to the experimental paints are given in Table 2. Paints in inverted cans were stored under ambient temperature (72°F) for predetermined periods.

LABORATORY PROCEDURES

Pigment Separation

Centrifuging. Paint samples were removed from storage for analysis every 3 months. The pigment was separated from each paint by a centrifuge method described in Reference 6. After centrifuging, the supernatant liquids were decanted from the centrifuge tubes and the pigment cakes removed, wrapped in filter paper, and placed in paper extraction thimbles.

Extraction. Each pigment cake in a paper extraction thimble was covered with a piece of glasswool and the thimble placed inside a Soxhlet extractor. Extraction with 100 cc of benzene was conducted for 4 hours to remove all traces of vehicle from the pigments. It was assumed that only strongly adsorbed drier remained with the pigment after this treatment. After extraction, each pigment was removed from the thimbles, oven-dried, and ground to a fine powder with a mechanical shaker.

Method of Counting Radioactivity

The amount of paint driers adsorbed on the pigment surface during storage was determined by counting radioactivity of the extracted pigments with a liquid scintillation spectrometer, which is considered the best system for counting soft beta rays. This equipment can also effectively count alpha, beta, x-ray, positron, and many gamma rays.

The scintillation solution used in this study was a mixture of two fluors - PPO (2,5-diphenyloxazole) and POPOP (p-bis-(2-5-phenyl-oxazolyl)-benzene) - dissolved in toluene. Forty grams of Cab-O-Sil* were added to each liter of scintillation solution to suspend the ground pigments in the solution during the counting.

Twenty milligrams of finely powdered pigment sample were placed in a counting vial containing a mixture of scintillation solution and Cab-O-Sil. The vial contents were then thoroughly mixed, using a mechanical mixer to obtain a homogeneous mixture. Triplicated samples were prepared from each pigment. Radioactivity for each vial was counted at least twice for a minimum of 20 and a maximum of 60 minutes, depending on the activity of the sample, to minimize the random counting error.

Estimation of Adsorbed Drier

The amounts of radioactive driers adsorbed on the pigments during storage were computed from regression equations derived by comparing experimental data to that from a series of standard solutions of known activities.** Regression equations were updated prior to counting each sample to compensate for the loss of activity by radioactive decay of both samples and standards.

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*A commercial pyrogenic silica powder made by Cabot Co., Boston, Mass. Its purpose and effectiveness will be detailed in later sections of this report.

**This derivation is described in later sections of this report.

Drying Time

Drying time of the six experimental paints with necessary driers were measured by casting films of these paints on polished, flat, 4 x 12-inch glass panels, which were cleaned with methylethylketone. A Bird applicator was used to apply a 2-mil wet-film thickness to the panels. Circular drying time recorders were placed on the wet films immediately after coating. The films were allowed to dry at approximately 72°F and 50% relative humidity. The recorders were removed from the films after 24 hours, and the thorough-dry times were recorded in hours. It was not meaningful, however, to determine drying times of these experimental paints because only one type of drier was added to each experimental paint. A combination of three driers are normally added to paints to achieve both surface and thorough drying. Most of the paints did not dry in 24 hours. Because drying time is sensitive to temperature, humidity, light, and airflow variations, drying time cannot easily be reproduced.

EFFECTS OF VARIABLES IN THE INVESTIGATION

To determine the validity and reliability of the sampling and counting methods described in the preceding sections, the following variables were analyzed before the actual measurements of adsorption of the drier were made. The liquid scintillation spectrometer was set to obtain maximum efficiency of counting Co-60, Pb-210, and Mn-54.

Fluor Concentration

Fluors are fluorescent aromatic compounds that absorb energy from solute molecules excited by ionizing particles and then re-emit energy at a wavelength compatible with the response of a photomultiplier of the scintillation counting system. Effects of the fluor concentration on counting rates of the radioactive driers were investigated by counting the drier with varied concentrations of the fluor in the scintillation solution. The data shown in Table 3 were analyzed statistically by linear regression; the regression line is illustrated in Figure 1. Results of the analysis indicated that slight variation of the fluor concentration will not cause a significant change in the counting rate within the range tested. This is illustrated graphically in Figure 1 where the regression line is parallel to the X-axis. The concentration of fluor in the scintillation solution was maintained at a concentration of approximately 40 ml/l of scintillation solution throughout the experiment.

Cab-O-Sil Concentration

For best results with a scintillation counter, radioactive substances should be dissolved in the solution of fluor ("cocktail"). Unfortunately, almost all of the paint pigments are insoluble in the scintillation solution. Thus, these insoluble pigments are likely to exhibit continuously

decreasing counting rates as the pigments settle to the bottom of the cocktail while counting. Counting can be made more reliable by increasing the viscosity of the cocktail solution to reduce the rate of settling. An effective method (Ref 9) of doing this is to use Cab-O-Sil (a thickening agent, aluminum stearate, or ricinoleic acid). The effect of Cab-O-Sil concentration on the counting rate was determined by counting radioactive drier with various concentrations of Cab-O-Sil in the scintillation solution. The data shown in Table 4 were analyzed statistically by regression as shown in Figure 2. The analysis indicated that variations of Cab-O-Sil concentration within the range tested did not significantly affect the counting rate. Figure 2, however, indicated a slight increase in counting rate with increasing concentration of Cab-O-Sil. Thus, the concentration of Cab-O-Sil in the scintillation solution was maintained constant at 40.0 gm/l.

Pigment Concentration and Color

Counting efficiency of liquid scintillation spectrometers can be reduced (quenched) by adsorption of visible wavelength by colored substances or reduced by sample particle size because of self-adsorption or interference. Effect of pigment concentration and color on counting rate was determined by counting the activity of the driers mixed with varied pigment concentrations and colors as shown in Table 5. Only three pigments - white (TT-P-105A), light gray (TT-E-489F), and dark gray (Mil-E-699C) - were used. The effect was analyzed statistically by regression.

Results of the analyses, shown graphically in Figure 3, indicated that the change in counting rate caused by variation of colored pigment concentration in TT-E-489F and Mil-E-699C was statistically very highly significant. Change in the counting rates was more pronounced with the dark-colored pigment than with the lighter-colored pigment (Figure 3).

The statistical analysis indicated that the concentration variation of the white pigment did not cause statistically significant changes in the counting rate. The regression line plotted for the white pigment, however, showed a slight increase on the counting rate with increasing white pigment concentration. Hence, all pigment samples were measured to a close tolerance of 20±1 mg for each sampling throughout the remaining experiments to obtain reliable and reproducible data.

Drier Concentration Versus Counting Rate

The validity of the counting method used in this experiment was determined by counting the radioactivity in the Co-60, Pb-210, and Mn-54 naphthenate driers at various concentrations mixed with pigment from each paint sample. The variables discussed in the preceding sections were taken into account during preparation of the standards. The example shown in Table 6 gives various concentrations of Co-60 drier mixed with pigment of TT-P-489F versus the counting rates of these concentrations. Appropriate backgrounds were subtracted from each counting. The regression line and its regression equation are shown in Figure 4; the resulting

straight line indicates that the counting rate is directly proportional to drier concentration. Statistical analysis of the data indicated that the relationship between the counting rate and the drier concentration was very highly significant. Hence, it was concluded that the counting method used to determine the amount of the drier was satisfactory for this experiment.

Regression equations were derived similarly for all other driers mixed with each pigment. These are summarized in Table B-1 of Appendix B. The regression lines for each paint were plotted together according to the drier and are illustrated in Figures B-1, B-2, and B-3 of Appendix B.

The plots of Figures B-1, B-2, and B-3 clearly illustrate that the counting rates were affected by the type of pigment present. The counting rate of the Mn-54 drier was more affected by the type of pigment than were the Co-60 and Pb-210 driers as illustrated in Appendix B (Figure B-1, B-2 versus B-3). The plots also illustrated that counting rates of all three driers were significantly affected by the presence of dark-colored pigment (sample no. 5 in Figure B-1, B-2, and B-3) compared to those mixed with pigment of lighter color. Results of the above experiments indicated that an appropriate regression equation for each drier and coating is required for accurate determination of adsorbed driers.

Reliability and Reproducibility

The reliability and reproducibility of the sampling and counting system described in the preceding sections were determined by counting each of the triplicated samples for 20 minutes. The results are shown in Table 7. Each sample was counted four times at 10-hour intervals to determine whether the pigment samples were suspended long enough in the scintillation solution to give reproducible counting rates.

The results of the analysis-of-variance given in Table 7 indicated that no significant difference was noted among the triplicated sample nor did any significant change occur in the recounted rate. From the results of the analysis it was concluded that the method of sampling and counting is reliable and reproducible and was satisfactory for use for this experiment.

LABORATORY RESULTS

The amounts of drier adsorbed by the pigments in the six radioactive experimental paints were determined by (1) separating the pigments from the paints by centrifuging and Soxhlet extraction and (2) counting their radioactivity by a liquid scintillation counter every 3 months during 12 months of storage. Appropriate regression equations were used to relate measured radioactivity to the amount of drier. All pigment samples were prepared in triplicate and counted twice for a minimum of 20 minutes each. Appropriate backgrounds were subtracted from each counting before the computations were made. The radioactivity detected, sample weights, backgrounds, and counts per unit weight of pigment are listed in the tables in Appendix C, according to the length of storage and type of paint drier in each paint.

Cobalt Naphthenate Drier

Table 8 shows the amount of cobalt naphthenate drier adsorbed on the pigments of different generic paint types during the 12 months of storage.* The amounts of drier ranged from 0.9 to 8.23 μg/mg of pigment. The last column of Table 8 lists percentages by weight of the total drier adsorbed at the end of the 12 months; these ranged from 20.28% in TT-P-105A to 65.43% in TT-E-490E. The amount of adsorption versus length of storage was plotted (see Figure 5).

Figure 5 clearly indicates that the amount of adsorbed cobalt drier differs from one generic type of paint to another. The pigments in oil and oil-alkyd paints (no. 2 and 3) adsorbed the drier much less (20.28% and 21.60%, respectively) and alkyd and silicone-alkyd paints (no. 1 and 4) adsorbed much more (57.22% and 65.43%, respectively) than the other two paints tested. The pigment in vinyl-alkyd and phenolic-alkyd paint (no. 5 and 6) adsorbed the drier moderately. Figure 5 indicates that the adsorption rate of cobalt drier was greatest during the first 3 months of storage and stayed relatively constant during the remaining 9 months.

A statistical analysis-of-variance (F-test) was performed to ascertain whether variations in adsorption data among the six paints and variations in data after different storage periods were due to the standard deviation of individual measurements or were true differences in adsorptions. The critical F-values at the 0.01 level were 4.41 for 5 and 100 degrees-of-freedom for six paints and 7.41 for 2 and 100 degrees-of-freedom for three storage periods (6, 9, and 12 months). The F-ratios obtained (753.01 and 27.36 for paints and storage periods, respectively) far exceeded their critical values; therefore the results were considered statistically very highly significant. This indicated that the difference in the adsorption data among the paints and storage periods was not due to the standard deviation of individual measurements but were true differences in drier adsorption. Individual measurements according to the type of paint and length of storage period and computation of the analysis-of-variance are given in Table D-1 of Appendix D.

Lead Naphthenate Drier

Table 9 shows the amount of lead naphthenate drier adsorbed on the pigments of the different generic type of paint during the 12 months of storage. The amounts of the adsorbed drier ranged from 6.34 to 20.57 μg/mg of the pigment, considerably more than the cobalt drier adsorbed (0.9 to 8.23 μg/mg) on these pigments. The last column of Table 9 lists percentage of the total drier adsorbed by the pigment after 12 months of storage. This percentage ranged from 38.14% for the oil-alkyd paint to 67.74% for the silicone alkyd paint. Amount of the adsorption versus length of the storage was plotted, as illustrated graphically in Figure 6.

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*The 3-month data for paint no. 3, 4, 5, and 6 in Table 8 are not listed because of experimental difficulties encountered.

Figure 6 again indicates that the amount of lead drier adsorbed during storage differs from one generic type of paint to another. The pigment from the oil-alkyd paints adsorbed the least amount (38.14% by weight of total drier), and the pigment from the silicone-alkyd again adsorbed the most (67.74% of total drier). The pigment from phenolic-alkyd and vinyl-alkyd paints adsorbed modest amounts of the drier. Figure 6 also indicates that the adsorption took place during the first 3 months of storage and changed only slightly thereafter. As in the preceding section, a statistical analysis-of-variance was performed to ascertain whether the variation in values for adsorption among the six paints and variation in values between the storage periods were due to the standard deviation of individual measurements or true differences in lead drier adsorption. For 5 and 120 degrees-of-freedom for six paints and for 3 and 120 degrees-of-freedom for four storage periods, the critical F-value at 0.01 level was 4.48 and 5.85, respectively. The F-ratio obtained, 161.44 for the paints and 11.56 for the storage periods, far exceeded their critical values; therefore the results were statistically very highly significant. Individual adsorption data for different types of paint and storage periods and computation of the analysis-of-variance are given in Table D-2 of Appendix D.

Manganese Naphthenate Drier

Table 10 shows the amount of manganese naphthenate drier adsorbed on pigment surfaces of each generic paint during 12 months of storage. The amounts of adsorbed drier ranged from 0.33 to 3.02 μg/mg of the pigment. The last column of Table 10 lists the percentages of total drier adsorbed after 12 months of storage. The percentage of the adsorption ranged from 19.96% (for the oil paint) to 94.63% (for the silicone-alkyd paint). Amount of adsorption versus length of storage was plotted (see Figure 7).

Figure 7 also indicates that the amounts of manganese drier adsorbed during the storage differ from one generic type to another. The pigment from the oil and oil-alkyd paint again adsorbed least (19.96% and 27.36%, respectively) and the pigment from the silicone-alkyd adsorbed more (94.63%) than the other paints tested (paint no. 2 and 3 versus no. 4 in Figure 7). The pigment from phenolic-alkyd and vinyl-alkyd adsorbed the drier modestly during storage. Figure 7 indicates that the pigment from alkyd and silicone-alkyd completed their adsorption during the first 3 months of storage while the pigments from other paints continued to adsorb the drier up to 9 months and then dropped back to the 3-month level during the remaining storage period.

As described in the preceding report sections, a statistical analysis-of-variance was performed. For 5 and 120 degrees-of-freedom for the six paints and for 3 and 120 degrees-of-freedom for the four storage periods, the critical F-values at 0.01 level were 4.48 and 5.85, respectively. The F-ratio obtained for paint and storage data - 48.46 and 8.85, respectively - far exceeded their critical values. Thus, the results were statistically very highly significant, and differences in adsorption data between the paints and between the storage periods are

true differences in the adsorption of drier. Individual adsorption data are listed in Table D-3 of Appendix D according to types of paints and storage periods, and computation of the analysis-of-variance is given.

DISCUSSION AND SUMMARY

A sensitive radioisotope tracer technique to measure the amount of paint drier adsorbed on paint pigments has been developed. The radioisotope tracer technique was found to be very sensitive and precise; it can measure quantities of 1 μg or less. Reliability and reproducibility of the procedure were very good; random error of the counting system was less than 2%. Because pigment color has a significant effect on the counting rate, samples must be specially prepared. Sensitivity of detecting smaller quantities of samples can be increased by using appropriate radioisotopes of higher activity.

The laboratory results clearly indicated that the amounts of the three driers adsorbed during storage varied among the paints. The pigment in the oil and oil-alkyd paints adsorbed less paint driers, and the pigments in the silicone-alkyd paint always adsorbed considerably more than other paints. The pigments in phenolic-alkyd and vinyl-aklyd paints adsorbed moderately in comparison.

Titanium dioxide pigment is reported in Reference 2 to have a strong tendency to adsorb paint driers during storage. Although it was true for alkyd (TT-E-489F) and silicone-alkyd (TT-E-490C) paints, it was not true for oil (TT-P-105A) and oil-alkyd (TT-P-81B) paints, which also contained considerable amounts of titanium dioxide pigment in comparison to other paints tested (see Appendix A). Carbon-black is also known (Ref 2) to have a strong tendency to adsorb paint driers during storage. However, it was moderately true for phenolic-alkyd (TT-E-699C) paint, which contained considerably more carbon-black than any other paint tested (as shown in Appendix A). It appears that the generic vehicle possesses more control over adsorption of paint driers than the pigment itself.

These experimental results appear to indicate a strong sign of interaction between the generic vehicle and the type of pigment upon the adsorption of paint driers. However, the significance of interaction cannot be determined with the specification paint samples used here. A series of experimental paints with two main isolated variables (vehicles and pigments) are required to determine the significance of interaction between them.

If the adsorption process is greatest during the first 3 months of storage, increased drying time should occur within those 3 months rather than after 1 year or more, which is found in actual practice. This apparent discrepancy may be resolved by the following explanation. Two types of adsorption processes take place during the storage of paints - physical and chemical.

Physical adsorption occurs where adhesional forces between adsorbate and adsorbent are relatively weak. The extent of the adsorption layer formed on the surface of the pigments by the adsorbate is dependent on the nature of the pigment-vehicle system.

Chemical adsorption, or chemisorption, on the other hand, occurs where adhesional forces between adsorbate and adsorbent are relatively strong, and a chemical bond is formed. This bond, however, cannot extend beyond one molecular layer (Ref 10). Chemisorption takes place very rapidly and is irreversible or reversible with great difficulty, while physical adsorption takes place slowly and is readily reversible. Since the pigments were extracted with benzene for 4 hours in a Soxhlet apparatus prior to counting their radioactivity, driers weakly bonded by physical adsorption were probably removed from the pigments and only driers strongly bonded by chemisorption were retained. Hence, Figures 5, 6, and 7 represent the amounts of chemically adsorbed driers. Relatively little change of adsorption values during the 12 months of storage indicate that chemisorption took place at an early stage of storage and rapidly reached its equilibrium by forming a monomolecular layer on the surface of the pigments.

What has yet to be investigated is the amount of drier physically adsorbed by the pigment during storage. The limited experimental results indicate that the amount of physically adsorbed paint driers and their reaction to the surrounding factors (such as type of vehicle, temperature, and humidity) may have a more profound effect on drying potential of the paint than the chemisorbed drier.

As in many other research works, while some of the initial questions have been answered, some new questions were raised during the course of this investigation. Some of the new questions were: (1) how does one determine physically adsorbed paint drier separately from the chemisorbed drier and (2) what are the effects of pigment/vehicle system, temperature, humidity, and aging on the physically adsorbed driers during paint storage. Additional work will be necessary to provide detailed information on the effects of drier adsorption on drying time.

RECOMMENDATIONS

As indicated in the previous section, this study is incomplete. Recommendations include the following:

1. An investigation on the amount of drier adsorbed physically (rather than chemically) by the pigment during storage be made. The factors affecting the physical adsorption should be a part of this more extensive investigation.

2. Basic research should be conducted to determine if surfaces of paint pigments can be precoated with tightly bonded vehicle prior to introduction of drier into the paint so that no area is available on the pigment surface for adsorption of drier.

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Mr. T. Tree, formerly of CEL, prepared specimens, conducted laboratory experiments, and compiled a large portion of the experimental data presented in this report.

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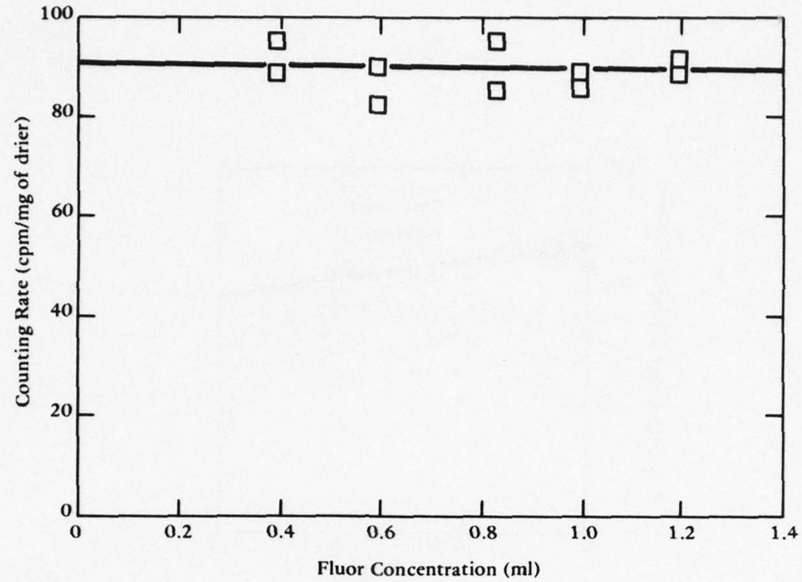

Figure 1. Effect of fluor concentration on counting rate.

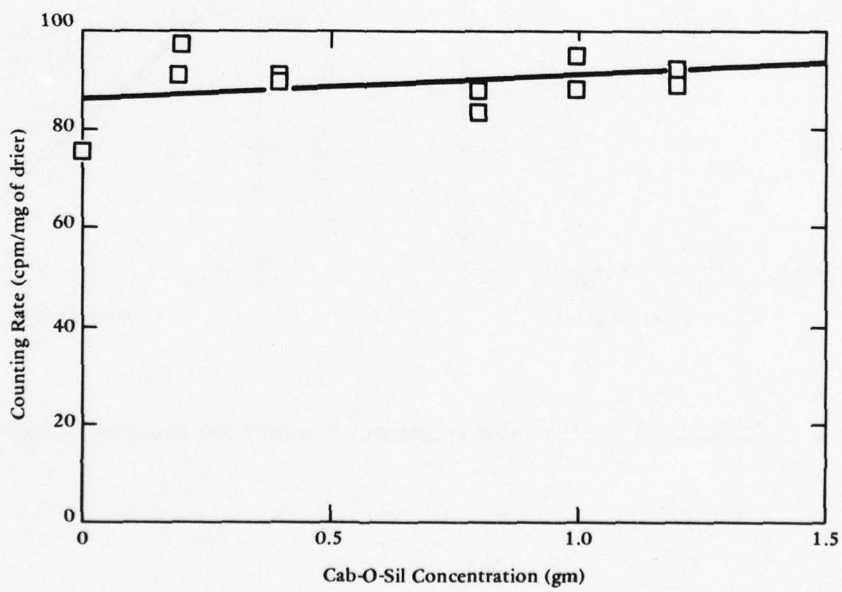

Figure 2. Effect of Cab-O-Sil concentration on counting rate.

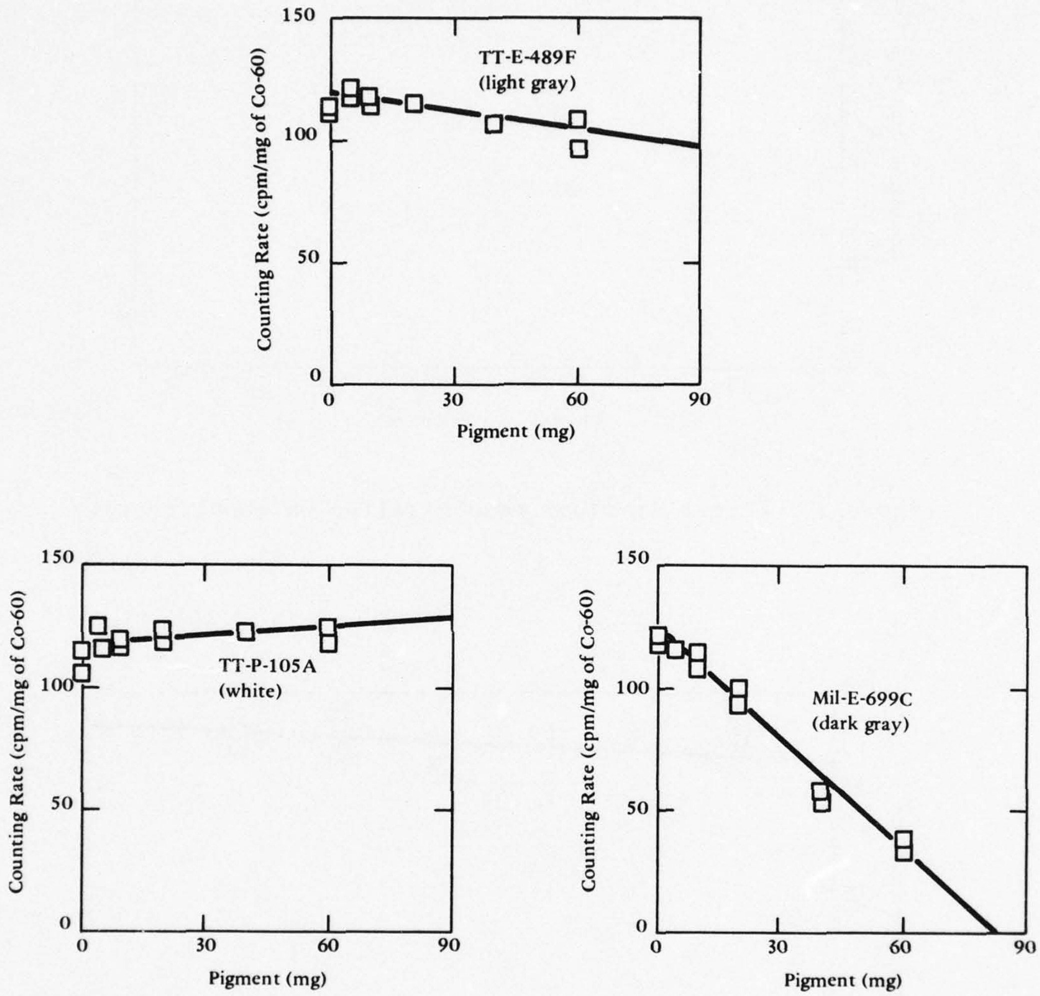

Figure 3. Effect of color and pigment concentration on counting rate.

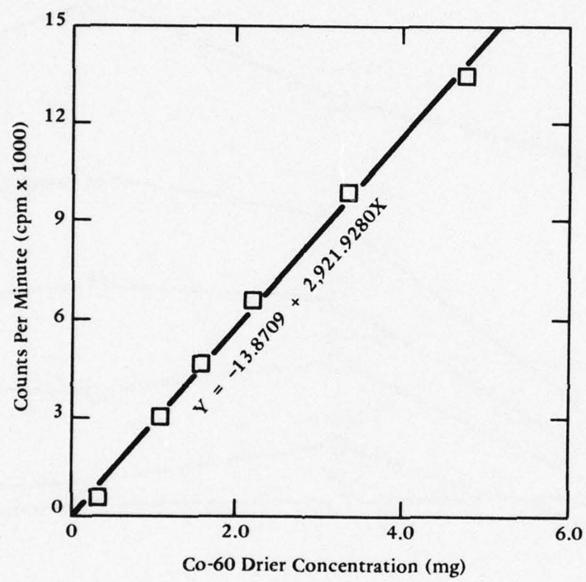

Figure 4. Regression line of sample Co-60 drier concentration versus counting rate.

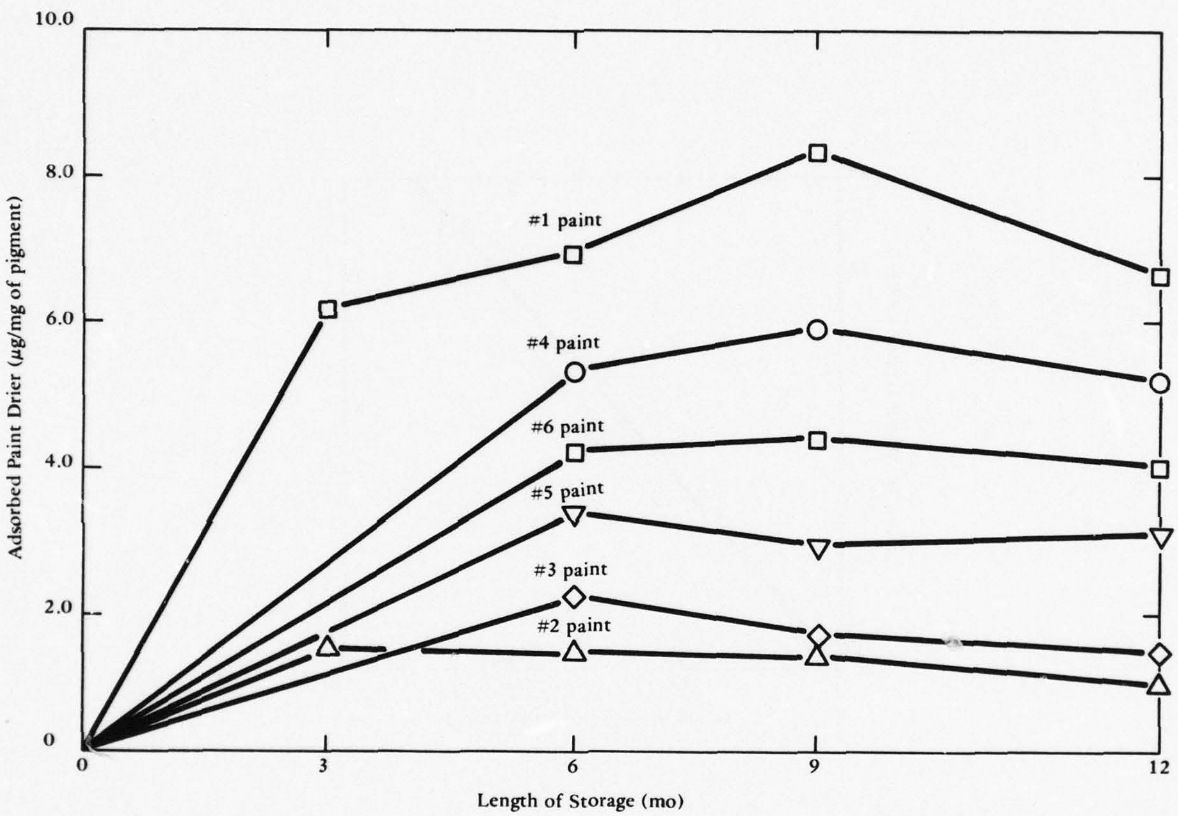

Figure 5. Adsorption of cobalt paint drier by pigments during storage.

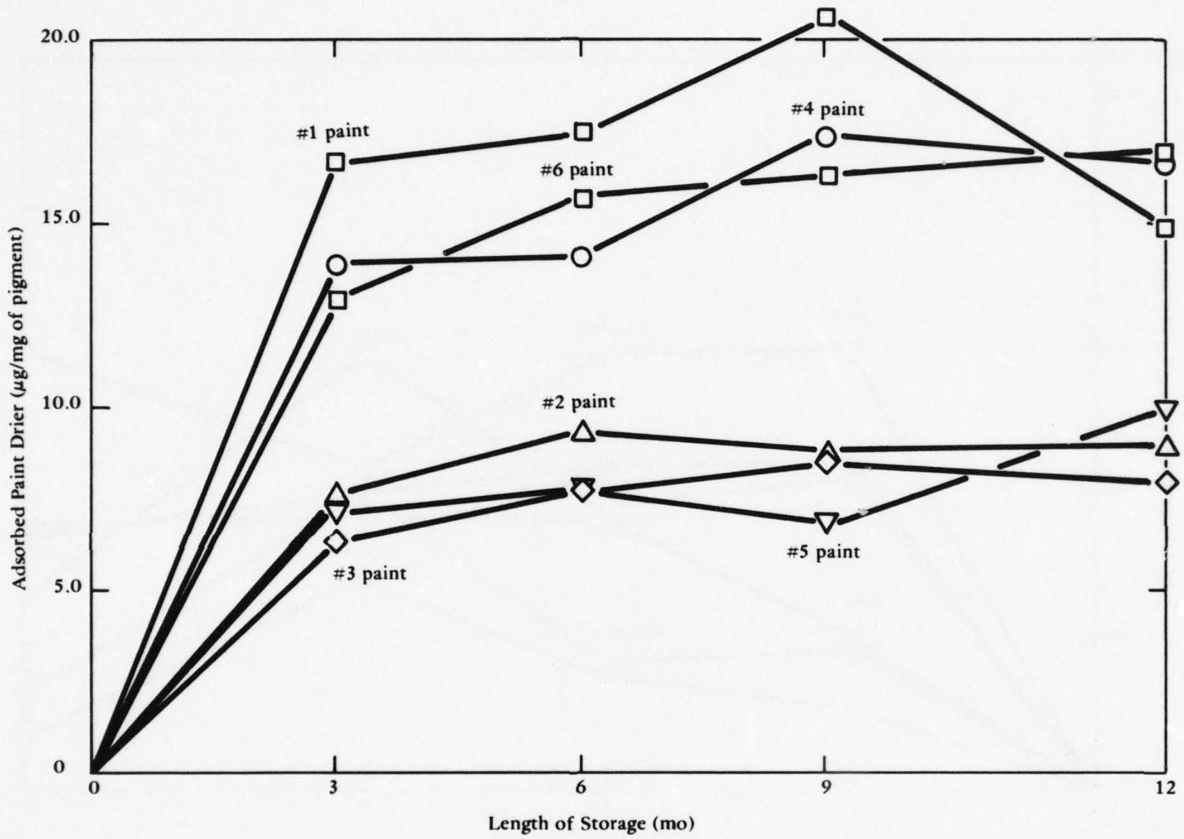

Figure 6. Adsorption of lead paint drier by pigments during storage.

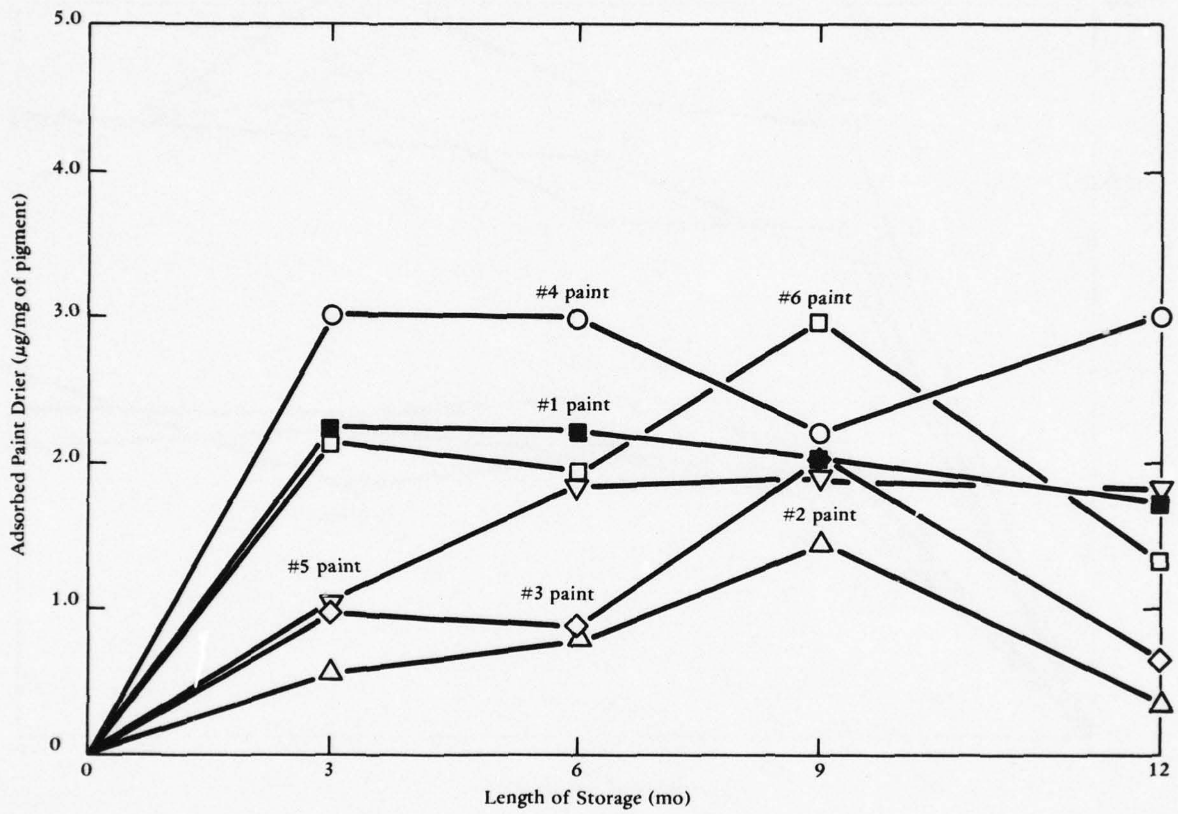

Figure 7. Adsorption of manganese paint drier by pigments during storage.

Table 1. Coating Analysis

Paint			Weight Per Gallon (lb)	Specific Gravity (gm/ml)	Viscosity (KU)	Total Solid Weight (%)	Pigment Weight (%)	Vehicle Solid Weight (%)
No.	Specification	Generic Type						
1	TT-E-489F	alkyd	7.52	1.142	100	60.96	28.59	32.37
2	TT-P-105A	oil	13.15	1.578	82	93.54	60.38	33.16
3	TT-P-81B	oil-alkyd	10.93	1.312	78	82.29	44.51	37.78
4	TT-E-490E	silicone-alkyd	9.79	1.175	91	61.64	32.43	29.21
5	Mil-E-699C	phenolic-alkyd	10.39	1.247	85	70.30	42.63	27.67
6	Mil-P-16188B	vinyl-alkyd	9.09	1.091	76	49.51	25.43	24.07

Table 2. Concentration of Radioactive and Nonradioactive Paint Driers in Experimental Paints

Paint		Paint (gm)	Drier		Paint (gm)	Drier	
No.	Specification		(gm)	(% by wt)		(gm)	(% by wt)
		Co-60 Drier			Co Drier		
1	TT-E-489F	257.276	0.815	0.32	234.250	0.588	0.25
2	TT-P-105A	360.900	1.019	0.28	342.700	0.923	0.27
3	TT-P-81B	293.150	0.822	0.28	309.125	0.819	0.26
4	TT-E-490E	275.850	0.803	0.29	277.133	0.778	0.28
5	Mil-E-699C	294.050	0.824	0.28	275.300	0.706	0.26
6	Mil-P-16188B	248.725	0.714	0.29	233.750	0.839	0.36
		Pb-210 Drier			Pb Drier		
1	TT-E-489F	257.300	2.335	0.91	241.755	1.777	0.74
2	TT-P-105A	365.850	3.308	0.90	329.834	2.323	0.70
3	TT-P-81B	306.600	2.799	0.91	303.509	2.265	0.75
4	TT-E-490E	265.725	2.420	0.91	277.500	1.980	0.71
5	Mil-E-699C	297.575	2.718	0.91	281.975	2.105	0.75
6	Mil-P-16188B	242.450	2.273	0.94	232.250	1.645	0.71
		Mn-54 Drier			Mn Drier		
1	TT-E-489F	257.275	0.258	0.10	251.775	0.334	0.13
2	TT-P-105A	362.525	0.363	0.10	335.125	0.373	0.11
3	TT-P-81B	300.300	0.308	0.10	301.275	0.278	0.09
4	TT-E-490E	270.250	0.320	0.12	263.125	0.293	0.11
5	Mil-E-699C	290.575	0.292	0.10	285.475	0.285	0.10
6	Mil-P-16188B	245.700	0.248	0.10	236.200	0.228	0.10

Table 3. Effect of Fluor Concentration on Counting Rate

Sample No.	Radioactivity (cpm)[a]	Weight of Drier (mg)	Fluor (ml/vial)	Radioactivity Per Milligram of Drier (cpm)
1	390.3	4.1	0.40	95.195
2	328.1	3.7	0.40	88.676
3	378.6	4.2	0.60	90.143
4	420.3	5.1	0.60	82.412
5	420.3	4.9	0.84	85.776
6	410.2	4.3	0.84	95.395
7	359.4	4.2	1.00	85.571
8	392.4	4.4	1.00	89.182
9	421.8	4.6	1.20	91.696
10	412.5	4.6	1.20	89.674

[a]cpm = counts per minute.

Table 4. Effect of Cab-O-Sil Concentration on Counting Rate

Sample No.	Radioactivity (cpm)	Weight of Drier (mg)	Weight of Cab-O-Sil (gm)	Radioactivity Per Milligram of Drier (cpm)
1	38.1	0.0	0.0	0.00
2	34.9	0.0	0.0	0.00
3	295.6	3.9	0.0	75.79
4	296.6	3.7	0.0	80.16
5	518.2	5.7	0.2	90.91
6	447.0	4.6	0.2	97.17
7	392.9	4.4	0.4	89.30
8	416.2	4.6	0.4	90.48
9	341.8	4.1	0.8	83.37
10	360.7	4.1	0.8	87.98
11	399.3	4.2	1.0	95.07
12	351.1	4.0	1.0	87.78
13	364.6	4.1	1.2	88.93
14	359.6	3.9	1.2	92.21

Table 5. Effect of Color and Pigment Concentration on Counting Rate

Paint	Radioactivity (cpm)	Pigment Weight (mg)	Drier Weight (mg)	Radioactivity Per Milligram of Drier (cpm)
TT-E-489F (light gray)	524.2	0.0	4.7	111.53
	514.2	0.0	4.5	114.27
	480.3	5.2	4.1	117.15
	496.5	5.3	4.1	121.10
	472.3	9.8	4.0	118.08
	534.6	10.2	4.7	113.74
	477.2	20.3	4.1	116.39
	461.2	19.9	4.0	115.30
	471.0	40.0	4.4	107.05
	434.8	39.8	4.0	108.70
	376.3	60.1	3.5	107.51
	383.7	60.0	4.0	95.93
TT-P-105A (white)	533.4	0.0	4.7	113.49
	501.2	0.0	4.8	104.42
	494.4	4.8	4.0	123.60
	416.5	5.0	3.6	115.69
	465.3	9.7	4.0	116.33
	465.1	9.9	3.9	119.26
	484.3	20.2	4.1	118.12
	464.3	19.8	3.8	122.18
	434.0	40.0	3.6	120.56
	457.5	39.9	3.7	123.65
	430.8	59.9	3.5	123.09
	469.3	59.8	4.0	117.33
Mil-E-699C (dark gray)	506.6	0.0	4.3	117.81
	486.3	0.0	4.0	121.58
	497.0	4.8	4.3	115.58
	512.2	5.2	4.4	116.41
	428.0	10.1	4.0	107.00
	479.4	9.9	4.2	114.14
	394.8	20.1	4.0	98.70
	381.0	20.1	4.1	92.93
	223.6	39.8	3.9	57.33
	223.1	40.3	4.1	54.41
	127.3	59.9	3.8	33.50
	154.7	60.3	4.1	37.73

Table 6. Concentration of Co-60 Drier Versus Counting Rate

Co-60 Drier (mg/vial)	Count Rate (cpm)
0.33	655.5
1.05	3,088.9
3.30	9,923.4
4.74	13,542.6
2.19	6,691.5
1.56	4,703.0
0.33	646.9
1.05	3,107.9
3.30	9,950.9
4.74	13,550.5
2.19	6,690.4
1.56	4,697.5
0.33	645.8
1.05	3,063.1
3.30	9,988.6
4.74	13,494.1
2.19	6,692.1
1.56	4,711.0

Table 7. Reliability and Reproducibility of Sampling and Counting Method

Sample No.	Radioactivity Counting Rate (cpm) for Sample Counts --				Mean
	1	2	3	4	
1	357.1	352.2	353.6	344.9	351.9
2	357.3	353.7	344.4	358.3	353.4
3	351.6	346.8	353.6	347.2	349.8
Mean	355.3	350.9	350.5	350.1	351.7

Analysis-of-Variance Summary

Source of Variation	Degree-of-Freedom	Sum of Squares	Mean Square	Significant Difference?
Recounting	3	52.9125	17.6542	No
Sampling	2	26.5850	13.2925	No
Experimental Error	6	179.7950	29.9658	
Total	11	259.3425		

Table 8. Adsorption of Co-60 Drier on Pigments During Paint Storage

Paint No.	Paint Specification	Adsorption of Drier (μg) Per Milligram of Pigment for --				Drier Adsorbed[a] (% by weight)
		3 mo	6 mo	9 mo	12 mo	
1	TT-E-489F	6.152	6.845	8.234	6.530	57.221
2	TT-P-105A	1.483	1.413	1.328	0.902	20.281
3	TT-P-81B	---	2.192	1.633	1.369	21.602
4	TT-E-490E	---	5.250	5.831	5.077	65.433
5	Mil-E-699C	---	3.378	2.922	2.956	42.948
6	Mil-P-16188B	---	4.160	4.359	3.903	32.306

[a]Average = 39.96%.

Table 9. Adsorption of Pb-210 on Pigments During Paint Storage

Paint No.	Paint Specification	Adsorption of Drier (μg) Per Milligram of Pigment for --				Drier Adsorbed[a] (% by weight)
		3 mo	6 mo	9 mo	12 mo	
1	TT-E-489F	16.667	17.393	20.576	14.896	47.00
2	TT-P-105A	7.494	9.163	8.704	8.894	58.74
3	TT-P-81B	6.349	7.722	8.491	7.902	38.14
4	TT-E-490E	13.924	14.057	17.343	16.489	67.74
5	Mil-E-699C	7.332	7.865	6.995	9.932	43.34
6	Mil-P-16188B	12.913	15.673	16.264	16.943	43.04

[a]Average = 49.67%.

Table 10. Adsorption of Mn-54 on Pigments During Paint Storage

Paint No.	Paint Specification	Adsorption of Drier (μg) Per Milligram of Pigment for --				Drier Adsorbed[a] (% by weight)
		3 mo	6 mo	9 mo	12 mo	
1	TT-E-489F	2.241	2.218	2.026	1.703	47.43
2	TT-P-105A	0.547	0.767	1.427	0.334	19.96
3	TT-P-81B	0.987	0.887	2.035	0.637	27.36
4	TT-E-490E	3.023	2.985	2.175	3.012	94.63
5	Mil-E-699C	1.109	1.867	1.926	1.805	71.72
6	Mil-P-16188B	2.152	1.936	2.976	1.326	31.33

[a]Average = 48.74%.

Appendix A

PAINT FORMULATIONS

The specifications for the six paints used in the tests follow.

Ingredients	Weight* (lb)
Paint No. 1, TT-E-489F, Light Gray	
Titanium Dioxide	250.0
Beckosol 11-082	603.5
Bentone #34	5.0
Alcohol	0.5
Nuact Paste	1.5
Anti-Terra U	4.0
Mineral Spirits	30.0
Hi-Flash Naphtha #114	14.5
Post #4	4.0
Total Weight	913.0
Paint No. 2, TT-P-105A, White	
Busan 11-M-1	280.0
Titanium Dioxide	200.0
15-15 Calcium Carbonate	320.0
Raw Linseed Oil	133.0
Z2 Bodied Linseed Oil	277.0
Mineral Spirits	123.0
Anti-Terra U	4.0
Total Weight	1,337.0
Paint No. 3, TT-P-81B, White	
Busan 11-M-1	250.0
Titanium Dioxide	100.0
15-15 Calcium Carbonate	250.0
Talc Hi-Fine 80	350.0
Anti-Terra U	2.0
Bentone #34	2.0
Isophthalic Alkyd	525.0
Q Linseed Oil	98.0
Z2 Linseed Oil	70.0
Alkali Ref-Linseed	209.0
Mineral Spirits	305.0
Total Weight	2,161.0

*Per batch.

Paint No. 4, TT-E-490E, Light Gray

Titanium Dioxide	160.0
Talc Hi-Fine 80	206.0
Bentone #34	3.0
Alcohol	0.3
Anti-Terra U	4.0
McCloskey 333-60	466.0
Hi-Flash Naphtha	36.0
Mineral Spirits	116.0
Post #4	4.0
M.C. Black	1.56
M.C. Yellow Oxide	0.38
M.C. Red Oxide	0.09
Total Weight	997.33

Paint No. 5, Mil-E-699C, Very Dark Gray

Titanium Dioxide	36.0
Zinc Oxide	125.0
Lampblack	15.0
Magnesium Silicate	135.0
Silica, pulverized	100.0
Alkyd Resin solution	221.0
Phenolic Varnish	240.0
Petroleum Spirits	159.0
Total Weight	1,031.0

Paint No. 6, Mil-E-16188B, Dark Gray

Titanium Dioxide	30.0
Zinc Oxide	110.0
Lampblack	2.4
Magnesium Silicate	80.0
Alkyd Resin	195.0
Vinyl Resin	75.0
Methyl Isobutyl Ketone	400.0
Xylene	40.0
Total Weight	932.4

Appendix B

REGRESSION EQUATIONS AND PLOTS

Table B-1. Regression Equations for Estimating Drier Adsorption

Paint No.	Sample Specification	Regression Equations for Following Driers		
		Co-60	Pb-210	Mn-54
1	TT-E-489F	$Y = -13.8709 + 2921.9280X$	$Y = 695.9666 + 14847.6065X$	$Y = -0.2404 + 257.6670X$
2	TT-P-105A	$Y = 49.2881 + 2985.5798X$	$Y = -16.9491 + 15368.3106X$	$Y = 7.4234 + 389.3709X$
3	TT-P-81B	$Y = -1.2248 + 3069.6771X$	$Y = 2.8140 + 15391.3310X$	$Y = 0.9053 + 438.8669X$
4	TT-E-490E	$Y = -15.3629 + 3236.9230X$	$Y = 37.1964 + 14797.8616X$	$Y = -0.9114 + 226.2881X$
5	Mil-E-699C	$Y = -3.8356 + 1710.8029X$	$Y = 2.5442 + 11448.7916X$	$Y = 1.1844 + 126.3328X$
6	Mil-E-16188B	$Y = 1.3570 + 3070.0755X$	$Y = -22.0104 + 15532.5924X$	$Y = -1.3888 + 215.7538X$

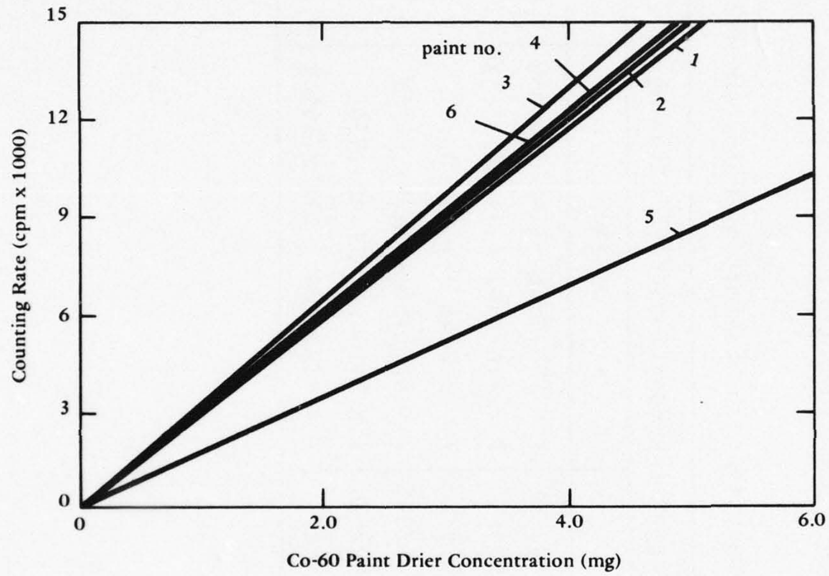

Figure B-1. Regression lines of concentration versus counting rate of Co-60 paint drier mixed with various pigments.

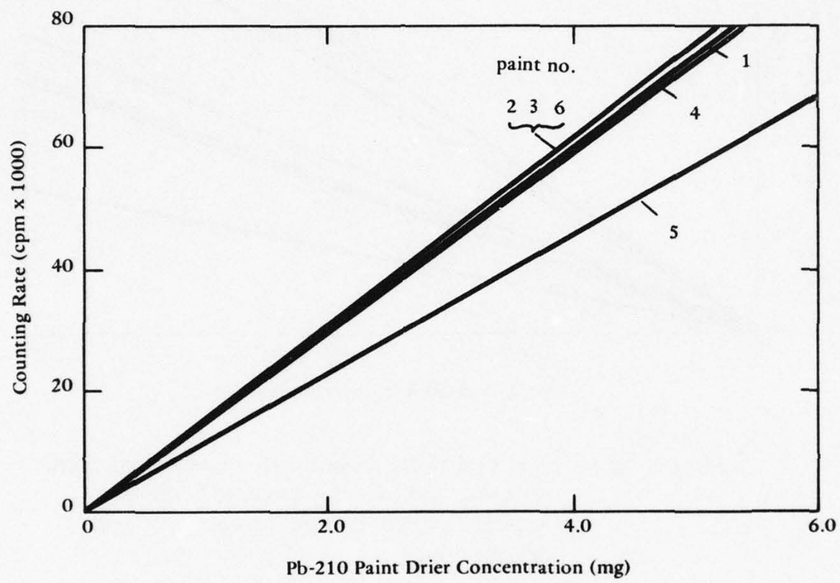

Figure B-2. Regression lines of concentration versus counting rate of Pb-210 paint drier mixed with various pigments.

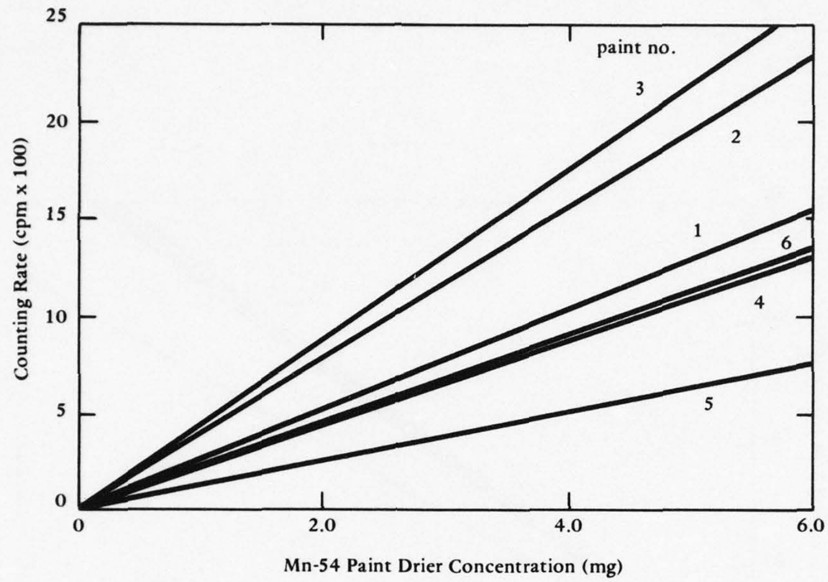

Figure B-3. Regression lines of concentration versus counting rate of Mn-54 paint drier mixed with various pigments.

Appendix C

RADIOACTIVITY COUNTS FOR DRIERS OVER A 12-MONTH PERIOD

Table C-1. Radioactivity of Cobalt-60 Drier Detected From Extracted Pigment of Paints Stored for 3 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	19.8	438.5	39.4	20.3
		20.1	356.3	35.7	15.9
		20.0	443.1	38.4	20.3
		19.8	409.9	38.0	18.8
		20.1	310.1	36.2	13.6
		20.0	395.8	36.0	17.9
2	TT-P-105A	20.0	187.7	44.5	7.3
		19.9	188.6	39.9	7.4
		19.8	191.5	42.3	7.6
		20.0	119.5	43.2	3.9
		19.9	128.5	40.7	4.4
		19.8	129.2	40.8	4.4
3	TT-P-81B[a]	20.0	-	43.4	-
		19.9	-	40.6	-
		19.9	-	39.8	-
		20.0	-	46.1	-
		19.9	-	40.8	-
		19.9	-	39.1	-
4	TT-E-490E[a]	20.1	-	36.4	-
		19.9	-	35.6	-
		20.0	-	34.8	-
		20.1	-	38.9	-
		19.9	-	37.1	-
		20.0	-	38.8	-
5	Mil-E-699C[a]	19.9	-	34.5	-
		20.1	-	32.1	-
		19.9	-	32.4	-
		19.9	-	35.1	-
		20.1	-	33.1	-
		19.9	-	32.8	-
6	Mil-P-16188B[a]	20.2	-	35.3	-
		20.1	-	34.7	-
		20.1	-	36.9	-
		20.2	-	38.3	-
		20.1	-	38.8	-
		20.1	-	37.5	-

[a]Three-month data not available because of experimental difficulties.

Table C-2. Radioactivity of Cobalt-60 Drier Detected From Extracted Pigment of Paints Stored for 6 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	20.1	454.6	39.4	20.8
		20.0	441.8	35.7	20.3
		19.9	433.2	38.4	19.9
		20.1	421.8	38.0	19.2
		20.0	428.3	36.2	19.6
		19.9	418.3	36.0	19.2
2	TT-P-105A	[illegible]0.1	159.2	44.5	5.8
		20.0	172.8	39.9	6.5
		20.0	163.9	42.3	6.1
		20.1	135.6	43.2	4.7
		20.0	147.4	40.7	5.3
		20.0	145.0	40.8	5.1
3	TT-P-81B	20.0	171.4	43.4	6.5
		20.0	174.6	40.6	6.6
		20.0	173.0	39.8	6.6
		20.0	158.2	46.1	5.8
		20.0	156.1	40.8	5.7
		20.0	218.3	39.1	8.8
4	TT-E-490E	20.0	385.2	36.4	17.4
		20.0	380.2	35.6	17.2
		20.1	373.3	34.8	16.8
		20.0	350.1	38.9	15.7
		20.0	345.1	37.1	15.4
		20.1	351.7	38.8	15.7
5	Mil-E-699C	20.0	158.7	34.5	6.3
		20.0	156.3	32.1	6.2
		20.0	149.1	32.4	5.8
		20.0	137.8	35.1	5.2
		20.0	135.4	33.1	5.1
		20.0	135.5	32.8	5.1
6	Mil-P-16188B	20.1	310.8	35.3	13.6
		20.0	293.4	34.7	12.8
		20.0	311.1	36.9	13.7
		20.1	294.8	38.3	12.8
		20.0	274.3	38.8	11.9
		20.0	279.6	37.5	12.1

Table C-3. Radioactivity of Cobalt-60 Drier Detected From Extracted Pigment of Paints Stored for 9 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	19.9	513.6	39.4	23.9
		20.0	497.8	35.7	23.1
		19.9	493.2	38.4	22.9
		19.9	533.6	38.0	24.9
		20.0	522.9	36.2	24.3
		19.9	516.2	36.0	24.1
2	TT-P-105A	20.1	150.5	44.5	5.4
		20.1	151.1	39.9	5.4
		20.0	145.1	42.3	5.2
		20.1	144.9	43.2	5.1
		20.1	152.5	40.7	5.5
		20.0	148.9	40.8	5.4
3	TT-P-81B	19.9	138.6	43.4	4.9
		20.0	140.7	40.6	5.0
		19.9	143.8	39.8	5.1
		19.9	143.3	46.1	5.1
		20.0	142.1	40.8	5.0
		19.9	135.2	39.1	4.7
4	TT-E-490E	20.1	403.2	36.4	18.2
		20.1	399.9	35.6	18.1
		20.0	402.7	34.8	18.3
		20.1	405.8	38.9	18.4
		20.1	404.6	37.1	18.3
		20.0	401.6	38.8	18.2
5	Mil-E-699C	20.0	131.0	34.5	4.9
		19.9	129.2	32.1	4.8
		20.0	130.4	32.4	4.9
		20.0	131.1	35.1	4.9
		19.9	129.1	33.1	4.8
		20.0	128.8	32.8	4.8
6	Mil-P-16188B	20.0	308.9	35.3	13.6
		20.0	312.3	34.7	13.7
		20.0	304.0	36.9	13.3
		20.0	303.3	38.3	13.3
		20.0	305.5	38.8	13.4
		20.0	301.4	37.5	13.2

Table C-4. Radioactivity of Cobalt-60 Drier Detected From Extracted Pigment of Paints Stored for 12 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	20.1	422.9	37.5	19.2
		19.9	412.9	35.3	18.9
		19.9	414.3	35.6	19.0
		20.1	419.9	35.8	19.1
		19.9	409.9	35.5	18.8
		19.9	402.6	36.3	18.4
2	TT-P-105A	20.1	127.0	41.2	4.2
		20.0	125.2	41.3	4.2
		20.0	120.9	42.6	3.9
		20.1	120.7	43.6	3.9
		20.0	122.7	40.4	4.0
		20.0	123.1	42.5	4.1
3	TT-P-81B	19.9	123.2	45.7	4.1
		19.9	125.4	39.1	4.2
		20.0	123.0	41.7	4.0
		19.9	122.1	43.6	4.0
		19.9	126.9	42.5	4.3
		20.0	129.6	40.8	4.4
4	TT-E-490E	20.0	352.2	39.0	15.7
		20.0	353.7	38.8	15.8
		19.9	346.8	35.6	15.5
		20.0	357.1	36.5	16.0
		20.0	357.3	35.6	16.0
		19.9	351.6	37.2	15.8
5	Mil-E-699C	20.1	131.8	34.3	4.9
		20.0	134.6	34.8	5.0
		20.0	136.3	37.0	5.1
		20.1	129.0	33.0	4.7
		20.0	130.5	31.4	4.8
		20.0	132.1	35.3	4.9
6	Mil-P-16188B	20.0	276.5	38.3	12.0
		20.0	280.4	38.2	12.1
		20.1	282.4	39.5	12.2
		20.0	276.8	38.1	12.0
		20.0	274.3	36.4	11.8
		20.1	282.9	36.9	12.2

Table C-5. Radioactivity of Lead-210 Drier Detected From Extracted Pigment of Paints Stored for 3 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	19.9	5,065.8	37.0	252.7
		19.9	4,976.3	39.0	248.2
		20.1	5,479.8	33.6	270.8
		19.9	5,048.0	37.8	251.8
		19.9	4,943.3	36.3	246.5
		20.1	5,471.7	38.6	270.4
2	TT-P-105A	20.0	2,308.7	47.0	113.2
		19.9	2,339.4	41.4	115.3
		19.9	2,347.2	43.8	115.7
		20.0	2,313.7	47.3	113.5
		19.9	2,336.8	41.1	115.2
		19.9	2,334.4	43.5	115.1
3	TT-P-81B	19.8	2,014.7	43.9	99.5
		19.9	1,997.2	45.6	98.1
		19.7	1,982.5	44.6	98.4
		19.8	1,987.3	44.7	98.1
		19.9	1,962.9	43.8	96.4
		19.7	1,944.7	44.5	96.5
4	TT-E-490E	19.8	4,156.1	39.3	207.9
		20.0	4,118.0	41.0	203.9
		20.1	4,237.3	38.3	208.8
		19.8	4,140.7	39.8	207.1
		20.0	4,167.6	43.3	206.4
		20.1	4,289.3	37.7	211.4
5	Mil-E-699C	19.9	1,716.3	33.0	84.6
		20.2	1,690.4	32.1	82.0
		19.9	1,688.3	34.9	83.2
		19.9	1,730.2	34.8	85.3
		20.2	1,759.3	31.9	85.4
		19.9	1,703.0	34.9	83.9
6	Mil-P-16188B	20.0	4,072.5	42.0	201.6
		20.1	3,955.3	42.2	194.7
		20.0	4,095.0	39.6	202.7
		20.0	4,058.0	42.3	200.8
		20.1	3,970.7	39.1	195.5
		20.0	4,088.0	41.1	202.3

Table C-6. Radioactivity of Lead-210 Drier Detected From Extracted Pigment of Paints Stored for 6 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	20.1	5,322.8	37.0	263.5
		19.8	5,314.0	39.0	266.2
		20.2	5,685.9	33.6	280.3
		20.1	5,314.9	37.8	263.1
		19.8	5,333.8	36.3	267.2
		20.2	5,389.3	38.6	265.6
2	TT-P-105A	20.1	2,458.7	47.0	120.0
		20.0	2,402.6	41.4	117.8
		19.7	3,682.8	43.8	184.5
		20.1	2,449.6	47.3	119.6
		20.0	2,423.5	41.1	118.8
		19.7	3,620.0	43.5	181.3
3	TT-P-81B	20.1	2,436.1	43.9	118.9
		20.0	2,460.8	45.6	120.9
		20.0	2,408.4	44.6	118.1
		20.1	2,432.9	44.7	118.8
		20.0	2,437.0	43.8	119.7
		20.0	2,393.1	44.5	117.3
4	TT-E-490E	20.1	4,260.6	39.3	210.0
		20.0	4,226.5	41.0	209.7
		19.9	4,178.8	38.3	208.2
		20.1	4,267.5	39.8	210.3
		20.0	4,250.8	43.3	211.0
		19.9	4,176.7	37.7	208.1
5	Mil-E-699C	20.1	1,937.4	33.0	94.9
		20.1	1,925.3	32.1	94.3
		20.0	1,644.3	34.9	80.7
		20.1	1,938.6	34.8	94.9
		20.1	1,913.7	31.9	93.8
		20.0	1,674.8	34.9	82.3
6	Mil-P-16188B	19.9	4,859.7	42.0	242.0
		20.0	4,861.1	42.2	241.2
		20.1	4,949.5	39.6	244.8
		19.9	4,854.9	42.3	241.8
		20.0	4,861.9	39.1	241.3
		20.1	4,928.7	41.1	243.8

Table C-7. Radioactivity of Lead-210 Drier Detected From Extracted Pigment of Paints Stored for 9 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	20.0	6,266.7	36.4	311.0
		19.9	6,152.0	38.8	307.0
		20.0	6,384.7	36.6	317.7
		20.0	6,415.5	37.6	318.5
		19.9	6,342.3	36.4	316.5
		20.0	6,468.0	35.0	321.9
2	TT-P-105A	19.9	2,661.9	47.6	131.5
		20.0	2,712.9	43.0	133.3
		20.1	2,742.3	42.2	134.1
		19.9	2,694.4	45.1	133.1
		20.0	2,718.1	42.1	133.6
		20.1	2,740.5	44.3	134.0
3	TT-P-81B	19.9	2,664.4	48.7	131.5
		20.1	2,636.0	44.3	129.1
		20.0	2,666.1	46.1	131.0
		19.9	2,657.3	45.7	131.2
		20.1	2,669.0	44.5	130.7
		20.0	2,674.5	45.1	131.4
4	TT-E-490E	19.0	4,370.6	39.6	227.8
		20.1	4,412.6	41.8	218.1
		19.9	4,396.3	42.3	218.9
		19.0	4,383.4	39.8	228.5
		20.1	8,821.5	39.3	438.0
		19.9	4,380.8	39.7	218.1
5	Mil-E-699C	20.0	1,647.6	34.1	80.6
		20.0	1,589.9	31.0	78.0
		20.1	1,589.4	32.8	77.4
		20.0	1,706.2	33.1	83.5
		20.0	1,656.9	33.9	81.4
		20.1	1,647.0	33.0	80.3
6	Mil-P-16188B	20.1	5,042.2	46.2	249.0
		20.1	5,037.7	40.5	249.1
		20.0	5,096.6	45.2	253.2
		20.1	5,090.1	41.7	251.4
		20.1	5,082.1	40.3	251.4
		20.0	5,150.3	40.0	255.9

Table C-8. Radioactivity of Lead-210 Drier Detected From Extracted Pigment of Paints Stored for 12 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	20.0	5,185.6	36.4	257.1
		20.0	3,756.1	38.8	185.9
		20.0	5,004.8	36.6	247.9
		20.0	5,188.5	37.6	257.2
		20.0	3,750.3	36.4	185.6
		20.0	5,000.3	35.0	247.7
2	TT-P-105A	20.1	2,766.0	47.6	135.7
		20.0	2,740.9	43.0	134.9
		19.9	2,752.3	42.2	136.1
		20.1	2,788.6	45.1	136.8
		20.0	2,761.0	42.1	135.9
		19.9	2,784.4	44.3	137.7
3	TT-P-81B	20.0	2,487.5	48.7	122.1
		20.0	2,487.2	44.3	122.0
		20.1	2,468.1	46.1	120.6
		20.0	2,509.7	45.7	123.2
		20.0	2,472.5	44.5	121.3
		20.1	2,478.9	45.1	121.2
4	TT-E-490E	19.9	4,896.3	39.6	243.9
		20.0	4,945.3	41.8	245.7
		20.0	4,930.2	42.3	245.0
		19.9	4,910.4	39.8	244.6
		20.0	4,959.6	39.3	246.5
		20.0	4,983.8	39.7	247.7
5	Mil-E-699C	20.0	2,305.1	34.1	113.4
		20.0	2,283.2	31.0	112.6
		20.0	2,348.8	32.8	116.1
		20.0	2,283.8	33.1	112.4
		20.0	2,293.2	33.9	113.1
		20.0	2,334.9	33.0	115.4
6	Mil-P-16188B	19.9	5,301.3	46.2	263.7
		20.0	5,179.7	40.5	256.9
		20.0	5,366.4	45.2	265.7
		19.9	5,309.9	41.7	264.2
		20.0	5,176.8	40.3	256.7
		20.0	5,374.7	40.0	266.1

Table C-9. Radioactivity of Manganese-54 Drier Detected From Extracted Pigment of Paints Stored for 3 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	19.9	46.0	33.4	0.6
		19.9	42.2	35.6	0.4
		20.0	46.7	32.3	0.6
		19.9	48.0	37.1	0.7
		19.9	46.0	33.3	0.6
		20.0	49.0	36.2	0.7
2	TT-P-105A	20.2	45.7	41.3	0.4
		19.9	51.9	37.5	0.7
		19.7	45.3	37.5	0.4
		20.2	47.0	35.6	0.5
		19.9	52.5	35.1	0.7
		19.7	46.1	38.6	0.4
3	TT-P-81B	19.9	51.9	39.0	0.6
		19.9	48.7	38.2	0.5
		20.0	52.4	40.8	0.7
		19.9	46.6	38.7	0.4
		19.9	47.5	40.3	0.4
		20.0	48.7	38.7	0.5
4	TT-E-490E	19.9	45.7	34.8	0.5
		20.0	51.8	37.1	0.8
		20.0	48.3	35.1	0.6
		19.9	45.4	36.5	0.5
		20.0	50.0	35.4	0.7
		20.0	45.3	35.7	0.5
5	Mil-E-699C	19.8	32.7	29.6	0.2
		19.9	31.9	29.3	0.1
		20.0	35.2	29.4	0.3
		19.8	36.8	28.1	0.4
		19.9	31.9	30.1	0.1
		20.0	33.4	27.5	0.2
6	Mil-P-16188B	19.9	43.3	34.7	0.4
		19.9	43.4	36.6	0.4
		20.1	43.1	33.3	0.4
		19.9	44.2	35.8	0.4
		19.9	43.1	37.8	0.4
		20.1	42.1	38.0	0.3

Table C-10. Radioactivity of Manganese-54 Drier Detected From Extracted Pigment of Paints Stored for 6 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	19.9	50.5	33.4	0.8
		20.0	42.7	35.6	0.4
		20.0	44.4	32.3	0.5
		19.9	48.9	37.1	0.7
		20.0	45.1	33.3	0.5
		20.0	45.7	36.2	0.6
2	TT-P-105A	20.1	50.1	41.3	0.6
		20.1	40.1	37.5	0.1
		20.0	42.1	37.5	0.2
		20.1	49.6	35.6	0.6
		20.1	43.7	35.1	0.3
		20.0	41.9	38.6	0.2
3	TT-P-81B	19.9	45.1	39.0	0.3
		20.2	48.2	38.2	0.4
		20.0	50.4	40.8	0.6
		19.9	45.6	38.7	0.3
		20.2	49.1	40.3	0.5
		20.0	52.4	38.7	0.7
4	TT-E-490E	20.2	46.2	34.8	0.5
		20.0	48.5	37.1	0.6
		20.0	47.7	35.1	0.6
		20.2	47.3	36.5	0.6
		20.0	46.5	35.4	0.5
		20.0	49.6	35.7	0.7
5	Mil-E-699C	20.0	36.4	29.6	0.4
		20.1	34.6	29.3	0.3
		20.0	35.0	29.4	0.3
		20.0	36.0	28.1	0.4
		20.1	35.0	30.1	0.3
		20.0	36.5	27.5	0.4
6	Mil-P-16188B	20.0	40.4	34.7	0.2
		19.9	44.7	36.6	0.4
		20.1	43.8	33.3	0.4
		20.0	42.0	35.8	0.3
		19.9	40.0	37.8	0.2
		20.1	42.8	38.0	0.3

Table C-11. Radioactivity of Manganese-54 Drier Detected From Extracted Pigment of Paints Stored for 9 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	20.1	47.6	33.4	0.6
		20.1	44.7	35.6	0.5
		19.9	41.3	32.3	0.3
		20.1	45.8	37.1	0.6
		20.1	46.2	33.3	0.6
		19.9	46.0	36.2	0.6
2	TT-P-105A	19.9	56.0	41.3	0.9
		20.0	55.3	37.5	0.9
		20.1	53.6	37.5	0.8
		19.9	57.0	35.6	1.0
		20.0	55.3	35.1	0.9
		20.1	52.5	38.6	0.7
3	TT-P-81B	20.0	57.5	39.0	0.9
		20.1	60.6	38.2	1.1
		20.1	56.4	40.8	0.9
		20.0	56.8	38.7	0.9
		20.1	62.4	40.3	1.2
		20.1	57.7	38.7	0.9
4	TT-E-490E	20.0	43.0	34.8	0.4
		19.9	46.2	37.1	0.5
		19.1	38.2	35.1	0.1
		20.0	44.1	36.5	0.4
		19.9	45.3	35.4	0.5
		19.1	46.0	35.7	0.5
5	Mil-E-699C	19.9	34.4	29.6	0.3
		20.0	36.4	29.3	0.4
		20.0	36.3	29.4	0.4
		19.9	34.5	28.1	0.3
		20.0	34.6	30.1	0.3
		20.0	38.1	27.5	0.5
6	Mil-P-16188B	20.0	46.5	34.7	0.5
		20.0	45.7	36.6	0.5
		20.1	47.7	33.3	0.6
		20.0	45.2	35.8	0.5
		20.0	44.0	37.8	0.4
		20.1	51.7	38.0	0.8

Table C-12. Radioactivity of Manganese-54 Drier Detected From Extracted Pigment of Paints Stored for 12 Months

Paint		Radioactivity Counts			
No.	Specification	Pigment (mg)	Total (cpm)	Background (cpm)	Per Milligram of Pigment (cpm)
1	TT-E-489F	19.9	42.2	36.0	0.4
		20.0	44.0	32.5	0.5
		20.0	43.3	34.1	0.4
		19.9	43.9	34.7	0.5
		20.0	44.0	36.7	0.5
		20.0	43.1	35.2	0.4
2	TT-P-105A	19.9	43.2	40.0	0.2
		20.0	43.5	38.3	0.2
		19.9	43.6	39.7	0.2
		19.9	44.2	39.6	0.2
		20.0	45.9	40.0	0.3
		19.9	44.7	40.0	0.3
3	TT-P-81B	20.0	46.4	39.6	0.3
		19.9	46.4	40.2	0.3
		20.0	45.8	39.9	0.3
		20.0	47.1	38.6	0.4
		19.9	46.6	39.5	0.3
		20.0	45.2	42.0	0.3
4	TT-E-490E	20.1	47.6	36.3	0.6
		20.0	47.7	33.8	0.6
		19.9	46.8	35.2	0.6
		20.1	48.0	36.4	0.7
		20.0	49.5	33.9	0.7
		19.9	46.7	33.4	0.6
5	Mil-E-699C	20.1	35.1	31.2	0.3
		20.0	35.2	30.6	0.3
		20.0	35.8	30.9	0.3
		20.1	35.3	27.5	0.3
		20.0	35.5	29.0	0.3
		20.0	35.7	30.0	0.3
6	Mil-P-16188B	20.1	40.0	33.0	0.2
		19.9	39.9	34.0	0.2
		20.1	39.2	35.1	0.2
		20.1	39.1	36.9	0.2
		19.9	40.4	36.0	0.3
		20.1	39.4	35.8	0.2

Appendix D

ADSORPTION DATA FROM TESTS AND ANALYSIS-OF-VARIANCE OF DRIER ADSORPTION

Table D-1. Adsorption Data and Analysis-of-Variance of Cobalt Paint Drier (μg/mg)

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
1	TT-E-489F	6.999	7.180	8.248	6.641	
		5.494	7.000	7.965	6.542	
		7.008	6.880	7.906	6.560	
		6.505	6.620	8.589	6.587	
		4.706	6.768	8.396	6.491	
		6.198	6.623	8.302	6.359	
		6.15[illegible]	6.845	8.234	6.530	6.940
2	TT-P-105A	1.98[illegible]	1.498	1.355	0.963	
		2.005	1.728	1.364	0.935	
		2.064	1.579	1.270	0.863	
		0.840	1.105	1.262	0.858	
		0.996	1.304	1.387	0.893	
		1.013	1.264	1.333	0.900	
		1.483	1.413	1.329	0.902	1.282
3	TT-P-81B	-	2.134	1.601	1.338	
		-	2.179	1.632	1.379	
		-	2.153	1.685	1.332	
		-	1.919	1.678	1.320	
		-	1.878	1.655	1.404	
		-	2.890	1.545	1.440	
		-	2.192	1.633	1.369	1.731
4	TT-E-490E	-	5.576	5.828	5.053	
		-	5.507	5.781	5.082	
		-	5.376	5.835	4.992	
		-	5.034	5.868	5.129	
		-	4.964	5.853	5.137	
		-	5.043	5.818	5.067	
		-	5.250	5.831	5.077	5.386

continued

Table D-1. Continued

Paint No.	Paint Specification	Adsorption Data for Following Months of Storage: 3	6	9	12	Mean Average
5	Mil-E-699C	-	3.768	2.952	2.934	
		-	3.696	2.905	3.021	
		-	3.480	2.932	3.076	
		-	3.156	2.955	2.852	
		-	3.084	2.902	2.902	
		-	3.082	2.885	2.953	
		-	3.378	2.922	2.956	3.085
6	Mil-P-16188B	-	4.424	4.415	3.874	
		-	4.154	4.457	3.932	
		-	4.444	4.328	3.945	
		-	4.164	4.324	3.879	
		-	3.843	4.346	3.833	
		-	3.931	4.286	3.953	
		-	4.160	4.359	3.903	4.141
Mean Average		3.817	3.873	4.051	3.456	3.796

Analysis-of-Variance Summary

Source of Variation	Degree-of-Freedom	Sum of Squares	Mean Square	Significant?
Paint	5	462.37	92.47	Yes
Storage Period	2	6.72	3.36	Yes
Experimental Error	100	12.28	0.12	
Total	107	481.37		

Table D-2. Adsorption Data and Analysis-of-Variance of Lead Paint Drier (μg/mg)

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
1	TT-E-489F	16.392	17.166	20.284	16.686	
		16.093	17.293	20.012	11.940	
		17.602	18.241	20.728	16.076	
		16.333	17.089	20.779	16.695	
		15.982	17.360	20.649	11.920	
		17.575	17.259	21.006	16.061	
		16.663	17.401	20.576	14.896	17.384
2	TT-P-105A	7.400	7.841	8.586	8.861	
		7.537	7.694	8.706	8.810	
		7.563	12.040	8.758	8.888	
		7.416	7.811	8.694	8.934	
		7.529	7.762	8.723	8.876	
		7.521	11.832	8.752	8.993	
		7.494	9.163	8.704	8.894	8.564
3	TT-P-81B	6.458	7.720	8.538	7.925	
		6.368	7.850	8.378	7.920	
		6.384	7.665	8.501	7.831	
		6.368	7.709	8.515	7.997	
		6.256	7.773	8.485	7.873	
		6.260	7.615	8.528	7.866	
		6.349	7.722	8.491	7.902	7.616
4	TT-E-490E	13.944	14.087	15.284	16.377	
		13.676	14.070	14.633	16.502	
		14.009	13.965	14.687	16.451	
		13.891	14.110	15.329	16.425	
		13.843	14.153	29.490	16.550	
		14.183	13.958	14.635	16.632	
		13.924	14.057	17.343	16.490	15.454
5	Mil-E-699C	7.376	8.276	7.028	9.899	
		7.155	8.232	6.807	9.823	
		7.253	7.043	6.751	10.130	
		7.437	8.281	7.283	9.806	
		7.453	8.181	7.100	9.866	
		7.318	7.176	7.001	10.069	
		7.332	7.865	6.995	9.932	8.031

continued

Table D-2. Continued

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
6	Mil-P-16188B	13.039 12.599 13.122 12.992 12.648 13.089	15.644 15.593 15.823 15.628 15.596 15.756	16.092 16.102 16.365 16.246 16.245 16.538	17.042 16.599 17.166 17.070 16.590 17.193	
		12.915	15.673	16.265	16.943	15.449
Mean Average		10.780	11.980	13.062	12.510	12.083

Analysis-of-Variance Summary

Source of Variation	Degree-of-Freedom	Sum of Squares	Mean Square	Significant?
Paint	5	2,389.24	477.84	Yes
Storage Perid	3	102.61	34.20	Yes
Experimental Error	135	399.38	2.96	
Total	143	2,891.23		

Table D-3. Adsorption Data and Analysis-of-Variance of Manganese Paint Drier (μg/mg)

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
1	TT-E-489F	2.183	3.057	2.472	1.441	
		1.442	1.534	1.911	1.782	
		2.308	1.858	1.266	1.653	
		2.574	2.745	2.124	1.519	
		2.183	2.001	2.200	2.053	
		2.755	2.110	2.182	1.769	
		2.241	2.218	2.026	1.703	2.047
2	TT-P-105A	0.237	0.779	1.568	0.369	
		1.039	0.735	1.473	0.368	
		0.191	0.000	1.245	0.266	
		0.402	0.000	1.697	0.000	
		1.116	0.000	1.473	0.000	
		0.295	0.000	1.105	0.000	
		0.547	0.252	1.427	0.167	0.598
3	TT-P-81B	1.286	0.508	1.922	0.654	
		0.920	0.850	2.260	0.656	
		1.337	1.110	1.787	0.584	
		0.680	0.565	1.842	0.734	
		0.783	0.951	2.464	0.679	
		0.915	1.338	1.935	0.516	
		0.987	0.887	2.035	0.637	1.137
4	TT-E-490E	2.578	2.649	1.967	2.973	
		3.913	3.192	2.685	3.007	
		3.140	3.006	0.951	2.822	
		2.512	2.890	2.209	3.061	
		3.516	2.749	2.486	3.405	
		2.477	3.425	2.756	2.800	
		3.023	2.985	2.176	3.011	2.799
5	Mil-E-699C	0.735	2.197	1.405	1.670	
		0.413	1.474	2.197	1.713	
		1.716	1.634	2.157	1.955	
		2.373	2.888	1.445	1.749	
		0.413	1.631	1.483	1.831	
		1.004	2.226	2.871	1.915	
		1.109	1.867	1.926	1.806	1.677

continued

Table D-3. Continued

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
6	Mil-P-16188B	2.182 2.205 2.114 2.391 2.135 1.883	1.502 2.503 2.279 1.874 1.410 2.048	2.912 2.731 3.172 2.611 2.336 4.093	1.396 1.389 1.214 1.189 1.505 1.260	
		2.152	1.936	2.976	1.326	2.097
Mean Average		1.676	1.691	2.094	1.442	1.726

Analysis-of-Variance Summary

Source of Variation	Degree-of Freedom	Sum of Squares	Mean Square	Significant?
Paint	5	72.31	14.46	Yes
Storage Period	3	7.92	2.64	Yes
Experimental Error	135	40.28	0.29	
Total	143	120.53		

Table D-3. Adsorption Data and Analysis-of-Variance of Manganese Paint Drier (μg/mg)

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
1	TT-E-489F	2.183	3.057	2.472	1.441	
		1.442	1.534	1.911	1.782	
		2.308	1.858	1.266	1.653	
		2.574	2.745	2.124	1.519	
		2.183	2.001	2.200	2.053	
		2.755	2.110	2.182	1.769	
		2.241	2.218	2.026	1.703	2.047
2	TT-P-105A	0.237	0.779	1.568	0.369	
		1.039	0.735	1.473	0.368	
		0.191	0.000	1.245	0.266	
		0.402	0.000	1.697	0.000	
		1.116	0.000	1.473	0.000	
		0.295	0.000	1.105	0.000	
		0.547	0.252	1.427	0.167	0.598
3	TT-P-81B	1.286	0.508	1.922	0.654	
		0.920	0.850	2.260	0.656	
		1.337	1.110	1.787	0.584	
		0.680	0.565	1.842	0.734	
		0.783	0.951	2.464	0.679	
		0.915	1.338	1.935	0.516	
		0.987	0.887	2.035	0.637	1.137
4	TT-E-490E	2.578	2.649	1.967	2.973	
		3.913	3.192	2.685	3.007	
		3.140	3.006	0.951	2.822	
		2.512	2.890	2.209	3.061	
		3.516	2.749	2.486	3.405	
		2.477	3.425	2.756	2.800	
		3.023	2.985	2.176	3.011	2.799
5	Mil-E-699C	0.735	2.197	1.405	1.670	
		0.413	1.474	2.197	1.713	
		1.716	1.634	2.157	1.955	
		2.373	2.888	1.445	1.749	
		0.413	1.631	1.483	1.831	
		1.004	2.226	2.871	1.915	
		1.109	1.867	1.926	1.806	1.677

continued

Table D-3. Adsorption Data and Analysis-of-Variance of Manganese Paint Drier (μg/mg)

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
1	TT-E-489F	2.183	3.057	2.472	1.441	
		1.442	1.534	1.911	1.782	
		2.308	1.858	1.266	1.653	
		2.574	2.745	2.124	1.519	
		2.183	2.001	2.200	2.053	
		2.755	2.110	2.182	1.769	
		2.241	2.218	2.026	1.703	2.047
2	TT-P-105A	0.237	0.779	1.568	0.369	
		1.039	0.735	1.473	0.368	
		0.191	0.000	1.245	0.266	
		0.402	0.000	1.697	0.000	
		1.116	0.000	1.473	0.000	
		0.295	0.000	1.105	0.000	
		0.547	0.252	1.427	0.167	0.598
3	TT-P-81B	1.286	0.508	1.922	0.654	
		0.920	0.850	2.260	0.656	
		1.337	1.110	1.787	0.584	
		0.680	0.565	1.842	0.734	
		0.783	0.951	2.464	0.679	
		0.915	1.338	1.935	0.516	
		0.987	0.887	2.035	0.637	1.137
4	TT-E-490E	2.578	2.649	1.967	2.973	
		3.913	3.192	2.685	3.007	
		3.140	3.006	0.951	2.822	
		2.512	2.890	2.209	3.061	
		3.516	2.749	2.486	3.405	
		2.477	3.425	2.756	2.800	
		3.023	2.985	2.176	3.011	2.799
5	Mil-E-699C	0.735	2.197	1.405	1.670	
		0.413	1.474	2.197	1.713	
		1.716	1.634	2.157	1.955	
		2.373	2.888	1.445	1.749	
		0.413	1.631	1.483	1.831	
		1.004	2.226	2.871	1.915	
		1.109	1.867	1.926	1.806	1.677

continued

Table D-3. Continued

Paint		Adsorption Data for Following Months of Storage				Mean Average
No.	Specification	3	6	9	12	
6	Mil-P-16188B	2.182 2.205 2.114 2.391 2.135 1.883	1.502 2.503 2.279 1.874 1.410 2.048	2.912 2.731 3.172 2.611 2.336 4.093	1.396 1.389 1.214 1.189 1.505 1.260	
		2.152	1.936	2.976	1.326	2.097
Mean Average		1.676	1.691	2.094	1.442	1.726

Analysis-of-Variance Summary

Source of Variation	Degree-of Freedom	Sum of Squares	Mean Square	Significant?
Paint	5	72.31	14.46	Yes
Storage Period	3	7.92	2.64	Yes
Experimental Error	135	40.28	0.29	
Total	143	120.53		

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NAVSHIPYD; Code 202.4, Long Beach CA; Code 202.5 (Library) Puget Sound, Bremerton WA; Code 380, (Woodroff) Norfolk, Portsmouth, VA; Code 400, Puget Sound; Code 404 (LT J. Riccio), Norfolk, Portsmouth VA; Code 410, Mare Is., Vallejo CA; Code 440 Portsmouth NH; Code 440, Norfolk; Code 440, Puget Sound, Bremerton WA; Code 440.4, Charleston SC; Code 450, Charleston SC; L.D. Vivian; Library, Portsmouth NH; PWD (Code 400), Philadelphia PA; PWO, Mare Is.; PWO, Puget Sound; SCE, Pearl Harbor HI; Tech Library, Vallejo, CA
NAVSTA CO Naval Station, Mayport FL; CO Roosevelt Roads P.R. Puerto Rico; Dir Mech Engr, Gtmo; Engr. Dir., Rota Spain; Maint. Cont. Div., Guantanamo Bay Cuba; Maint. Div. Dir/Code 531, Rodman Canal Zone; PWD (LTJG.P.M. Motolenich), Puerto Rico; PWO Midway Island; PWO, Guantanamo Bay Cuba; PWO, Keflavik Iceland; PWO, Mayport FL; ROICC Rota Spain; ROICC, Rota Spain; SCE, Guam; SCE, San Diego CA; SCE, Subic Bay, R.P.; Utilities Engr Off. (LTJG A.S. Ritchie), Rota Spain
NAVSUBASE SCE, Pearl Harbor HI
NAVSUPPACT CO, Brooklyn NY; CO, Seattle WA; Code 4, 12 Marine Corps Dist, Treasure Is., San Francisco CA; Code 413, Seattle WA; LTJG McGarrah, Vallejo CA; Plan/Engr Div., Naples Italy
NAVSURFWPNCEN PWO, White Oak, Silver Spring, MD
NAVTECHTRACEN SCE, Pensacola FL
NAVWPNCEN Code 2636 (W. Bonner), China Lake CA; PWO (Code 26), China Lake CA; ROICC (Code 702), China Lake CA
NAVWPNSTA EARLE (Clebak) Colts Neck, NJ; Code 092, Colts Neck NJ; Maint. Control Dir., Yorktown VA; PW Office (Code 09C1) Yorktown, VA
NAVWPNSUPPCEN Code 09 Crane IN
NCBU 405 OIC, San Diego, CA
NCBC CEL AOIC Port Hueneme CA; Code 10 Davisville, RI; Code 155, Port Hueneme CA; Code 156, Port Hueneme, CA; Code 400, Gulfport MS; PW Engrg, Gulfport MS; PWO (Code 80) Port Hueneme, CA; PWO, Davisville RI
NCBU 411 OIC, Norfolk VA
NCR 20, Commander
NCSO BAHRAIN Security Offr, Bahrain
NMCB 133 (ENS T.W. Nielsen); 5, Operations Dept.; 74, CO; Forty, CO; THREE, Operations Off.
NOAA Library Rockville, MD
NORDA Code 440 (Ocean Rsch Off) Bay St. Louis MS
NRL Code 8400 Washington, DC; Code 8441 (R.A. Skop), Washington DC
NSC Code 54.1 (Wynne), Norfolk VA
NSD SCE, Subic Bay, R.P.
NTC Code 54 (ENS P. G. Jackel), Orlando FL; Commander Orlando, FL; OICC, CBU-401, Great Lakes IL
NUSC Code 131 New London, CT; Code EA123 (R.S. Munn), New London CT; Code TA131 (G. De la Cruz), New London CT
OCEANSYSLANT LT A.R. Giancola, Norfolk VA
ONR (Dr. E.A. Silva) Arlington, VA; BROFF, CO Boston MA; Code 700F Arlington VA; Dr. A. Laufer, Pasadena CA
PHIBCB 1 P&E, Coronado, CA
PMTC Pat. Counsel, Point Mugu CA

PWC ACE Office (LTJG St. Germain) Norfolk VA; CO Norfolk, VA; CO, Great Lakes IL; CO, Oakland CA; Code 120, Oakland CA; Code 120C (Library) San Diego, CA; Code 128, Guam; Code 200, Great Lakes IL; Code 200, Guam; Code 220 Oakland, CA; Code 220.1, Norfolk VA; Code 40 (C. Kolton) Pensacola, FL; Code 400, Pearl Harbor, HI; Code 400, San Diego, CA; Code 505A (H. Wheeler); Code 700, San Diego, CA; Code C10, San Diego Ca; Library, Subic Bay, R.P.; OIC CBU-405, San Diego CA; Utilities Officer, Guam; XO Oakland, CA
SPCC Code 122B, Mechanicsburg, PA; PWO (Code 120) Mechanicsburg PA
UCT TWO OIC, Port Hueneme CA
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US GEOLOGICAL SURVEY Off. Marine Geology, Piteleki, Reston VA
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USCG ACADEMY LT N. Stramandi, New London CT
USCG R&D CENTER Tech. Dir. Groton, CT
USDA Forest Products Lab, Madison WI; Forest Products Lab. (R. DeGroot), Madison WI
USNA Ocean Sys. Eng Dept (Dr. Monney) Annapolis, MD; Oceanography Dept (Hoffman) Annapolis MD; PWD Engr. Div. (C. Bradford) Annapolis MD; PWO Annapolis MD
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